IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:			
	Robert Cochran, et al.	§ Confirmation No.	9535
		§	
Serial No.:	10/697,821	§ Group Art Unit:	2163
		§	
Filed:	October 29, 2003	§ Examiner:	Vy, Hung T.
		§	
For:	HIERARCHICAL STORAGE SYSTEM	§ Atty Docket:	200311026-1 HPQB:0091
		§	
		§	

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February 9, 2010	/Christopher R. Rogers/
Date	Christopher R. Rogers

APPEAL BRIEF PURSUANT TO 37 C.F.R. §§ 41.31 AND 41.37

This Appeal Brief is being filed in response to the Final Office Action mailed on October 21, 2009, and in furtherance of a Notice of Appeal filed December 16, 2009.

1. **REAL PARTY IN INTEREST**

The real party in interest is Hewlett-Packard Development Company, LP, a limited partnership established under the laws of the State of Texas and having a principal place of business at 11445 Compaq Center Dr. W, Houston, TX 77070, U.S.A. (hereinafter "HPDC"). HPDC is a Texas limited partnership and is a wholly-owned affiliate of Hewlett-Packard Company, a Delaware Corporation, headquartered in Palo Alto, CA. The general or managing partner of HPDC is HPQ Holdings, LLC.

2. **RELATED APPEALS AND INTERFERENCES**

The Appellants are unaware of any other appeals or interferences related to this Appeal. The undersigned is Appellants' legal representative in this Appeal.

3. **STATUS OF CLAIMS**

Claims 1-25 are currently pending, are currently under rejection and, thus, are the subject of this appeal.

4. **STATUS OF AMENDMENTS**

There are no outstanding amendments to be considered by the Board.

5. **SUMMARY OF CLAIMED SUBJECT MATTER**

The Application contains five independent claims, namely, claims 1, 10, 18, 24, and 25, all of which are the subject of this Appeal. As an example, each of the independent claims relate generally to a hierarchical storage system that includes a storage array containing a plurality of storage devices of at least three types, each having a respective class hierarchy. *See* Application, p. 4, ll. 3-6. The subject matter of claims 1, 10, 18, 24, and 25 is summarized below.

With regard to independent claim 1, discussions of the recited features can be found at least in the below-cited locations of the specification and drawings. By way of

example, claim 1 recites a storage system (*e.g.*, 100 or 500) comprising a storage array (*e.g.*, 102 or 504). *See id.* at p. 4, ll. 4-6; p. 9, ll. 1-4; Figs. 1 and 5. The storage array comprises a cabinet (*e.g.*, 502) and a plurality of storage devices (*e.g.*, 506, 508, or 512) contained within the cabinet. *See id.* at p. 9, ll. 1-4; Fig. 5. The storage devices are of at least three different and distinct controller-to-storage device bus interface technology types including volatile solid-state (*e.g.*, 106 or 512) and nonvolatile disk types (*e.g.*, 108, 110, 506, or 508) in a single array (*e.g.*, 504). *See id.* at p. 4, ll. 16-22; p. 9, ll. 1-4; p. 9, ll. 12-13; Figs. 1 and 5. Each storage device has a respective class hierarchy. *See id.* The storage array also includes a controller (*e.g.*, 112 or 510) contained within the cabinet and coupled to the storage device plurality. *See id.* at p. 4, ll. 6-7; p. 9, ll. 5-6; Figs. 1 and 5. The controller executes hierarchical storage management and selectively controls usage of storage (*e.g.*, 106, 108, or 110) according to the different and distinct controller-to-storage device bus interface technology type (*e.g.*, 506, 508, or 512). *See id.* at p. 4, ll. 7-9; p. 9, ll. 7-8; Figs. 1 and 5. Furthermore, the controller allocates hierarchically inferior storage (*e.g.*, 606) for temporary storage, unexpected mission-critical storage, and hierarchical storage management (HSM)-type low usage data storage. *See id.* at p. 10, ll. 9-14; Fig. 6.

With regard to independent claim 10, discussions of the recited features can be found at least in the below-cited locations of the specification and drawings. By way of example, claim 10 recites a method (*e.g.*, Fig. 7) of managing information storage in a storage system (*e.g.*, 600). *See id.* at p. 10, ll. 4-5; p. 13, ll. 13-17; Figs. 6 and 7. The method includes enclosing a hierarchy of storage devices (*e.g.*, 602, 604, or 606) of at least three different and distinct controller-to-storage device bus interface technology types including volatile solid-state (*e.g.*, 602) and non-volatile disk types (*e.g.*, 604 or 606) in a cabinet (*e.g.*, 502) (*e.g.*, 702, 706, or 708). *See id.* at p. 9, ll. 1-4; p. 10, ll. 5-7; p. 13, ll. 13-17; Figs. 5, 6, and 7. The storage devices form a single array (*e.g.*, 504) and have a respective class hierarchy within a storage array. *See id.* at p. 10, ll. 5-7; p. 13, ll. 13-17; Figs. 6 and 7. The method also includes selectively controlling information usage of storage according to the different and distinct controller-to-storage device bus interface

technology type (*e.g.*, 704). *See id.* at p. 10, ll. 7-9; p. 13, ll. 13-17; Fig. 7. The method also includes using hierarchically inferior storage (*e.g.*, 606) for temporary storage, unexpected mission critical storage, and hierarchical storage management (HSM)-type low usage data storage. *See id.* at p. 10, ll. 9-14; Fig. 6.

With regard to independent claim 18, discussions of the recited features can be found at least in the below-cited locations of the specification and drawings. By way of example, claim 18 recites a storage system (*e.g.*, 100 or 500) comprising a disk array (*e.g.*, 102 or 504). *See id.* at p. 4, ll. 4-6; p. 9, ll. 1-4; Figs. 1 and 5. The disk array includes a cabinet (*e.g.*, 502) and a hierarchy of disk adapters (*e.g.*, 120 or 122) and coupled storage disks (*e.g.*, 108, 110) contained within the cabinet. *See id.* at p. 4, ll. 3-9; p. 6, ll. 17-20; p. 9, ll. 1-4; Figs. 1 and 5. The hierarchy of disk adapters and storage disks are of at least two different and distinct controller-to-storage device bus interface technology types. *See id.* at p. 4, ll. 16-22; p. 9, ll. 1-4, 12-13; Figs. 1 and 5. Each of the disk adapters and storage disks has a respective class hierarchy. *See id.* The disk array also includes a controller (*e.g.*, 112 or 510) coupled to the disk array and contained within the cabinet that executes a hierarchical storage management functionality that selectively controls access to the hierarchy of disk adapters and coupled storage disks. *See id.* at p. 4, ll. 7-9; p. 9, ll. 7-8; Figs. 1 and 5. The controller allocates hierarchically inferior storage for temporary storage, unexpected mission-critical storage, and hierarchical storage management (HSM)-type low usage data storage. *See id.* at p. 10, ll. 9-14.

With regard to independent claim 24, discussions of the recited features can be found at least in the below-cited locations of the specification and drawings. By way of example, claim 24 recites an article of manufacture (*e.g.*, 500) comprising a tangible computer-readable medium (*e.g.*, 610) having a program code for execution on a controller (*e.g.*, 510) embodied therein for managing a storage system (600). *See id.* at p. 10, ll. 16-18; p. 9, ll. 5-8; Figs. 5 and 6. The program code further comprises a code that causes the controller to intercommunicate among an hierarchy of storage devices (*e.g.*, 506, 508, 602, 604, or 606) of at least three different and distinct controller-to-storage

device bus interface technology types including volatile solid-state (*e.g.*, 512 or 602) and non-volatile disk types (*e.g.*, 604 or 606). *See id.* at p. 9, ll. 1-4, 12-13; p. 10, ll. 5-7; Figs. 5 and 6. The storage devices are in a cabinet (502) forming a single array (*e.g.*, 504) and having a respective class hierarchy within a storage array (*e.g.*, 504). *See id.* at p. 9, ll. 1-4; Fig. 5. The program code also includes a code that causes the controller to selectively control information access to the hierarchy of storage devices within the storage array. *See id.* at p. 9, ll. 7-8. The program code also includes a code that causes the controller to use hierarchically inferior storage for temporary storage, unexpected mission-critical storage. *See id.* at p. 10, ll. 9-14. The program code also includes hierarchical storage management (HSM)-type low usage data storage (*e.g.*, 606). *See id.* at p. 11, ll. 4-10; Fig. 6.

With regard to independent claim 25, discussions of the recited features can be found at least in the below-cited locations of the specification and drawings. By way of example, claim 25 recites a storage system (*e.g.*, 100 or 500) comprising means (*e.g.*, 112) for coupling a hierarchy of storage devices (*e.g.*, 506, 508 or 512) of at least three different and distinct controller-to-storage device bus interface technology types including volatile solid-state (*e.g.*, 106, 512) and non-volatile disk types (*e.g.*, 108, 110, 506, or 508). *See id.* at p. 4, ll. 16-22; p. 9, ll. 1-4, 12-13; Figs. 1 and 5. The storage devices are in a cabinet (*e.g.*, 502) forming a single array (*e.g.*, 504) and having a respective class hierarchy within a storage array (*e.g.*, 504). *See id.* at p. 9, ll. 1-4; Fig. 5. The storage system also includes means (*e.g.*, 112) for selectively controlling information access to the hierarchy of storage devices within the storage array. *See id.* at p. 4, ll. 7-9; p. 9, ll. 7-8; Figs. 1 and 5. The storage system also includes means (*e.g.*, 112) for using hierarchically inferior storage (*e.g.*, 606) for temporary storage, unexpected mission-critical storage, and hierarchical storage management (HSM)-type low usage data storage. *See id.* at p. 10, ll. 9-14; Figs. 1 and 6.

6. **GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

A. First Ground of Rejection for Review on Appeal

The Appellants respectfully urge the Board to review and reverse the Examiner's first ground of rejection in which the Examiner rejected claims 1-4, 10-13, 18-21, 24, and 25 under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over U. S. Patent No. 5,403,639 to Belsan, et al. (hereinafter "Belsan").

B. Second Ground of Rejection for Review on Appeal

The Appellants respectfully urge the Board to review and reverse the Examiner's second ground of rejection in which the Examiner rejected claims 5-9, 14-17, and 23 under 35 U.S.C. § 103(a) as being unpatentable over Belsan in view of U.S. Patent No. 7,047,358 to Lee, et al. (hereinafter "Lee").

C. Third Ground of Rejection for Review on Appeal

The Appellants respectfully urge the Board to review and reverse the Examiner's third ground of rejection in which the Examiner rejected claim 22 under 35 U.S.C. § 103(a) as being unpatentable over Belsan in view of U.S. Patent Application Publication No. 2003/0158999 by Hauck, et al. (hereinafter "Hauck").

7. **ARGUMENT**

As discussed in detail below, the Examiner has improperly rejected the pending claims. Further, the Examiner has misapplied long-standing and binding legal precedents and principles in rejecting the claims under 35 U.S.C. §§ 102(b) and 103(a). Accordingly, the Appellants respectfully request full and favorable consideration by the Board, as the Appellants assert that claims 1-25 are currently in condition for allowance.

A. Ground of Rejection No. 1

With respect to the rejection of claims 1-4, 10-13, 18-21, 24, and 25 under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being obvious over Belsan. With regard to independent claim 1, the Examiner stated:

> **Regarding claim 1**, Belsan et al. discloses a storage system and a method of managing information storage in a storage system comprising:
>
> a storage array a cabinet (i.e., "a data storage media environment that can be heterogeneous. Multiple types of media can be included within or connected to file server system 1" (col. 4, line 60-62) and fig. 1), a plurality of storage devices contained within the cabinet of at least three different and distinct controller-to-storage device bus interface technology types (i.e., "The data storage and management capability can include changing the format of the data stored to accommodate various combinations of heterogeneous data processors" (col. 2, line 18-22)) …
>
> …
>
> a controller contained within the cabinet (fig. 1) and coupled to the storage device plurality that executes hierarchical storage management and selectively controls (i.e., "The media used to store the data can be a disk array or any other media or combinations of media such as a disk array in combination with a backend automated magnetic tape cartridge library system, including a plurality of tape drives such that the file serve system comprises a hierarchical data storage system containing multiple types of media" (col. 3, line 30-35)) usage of storage according to the different and distinct controller-to-storage device bus interface technology type (i.e., "a third form of redundancy consists of high usage patterns" (col. 12, line 1-20) and "The disk drives 122-1 to 125-r are significantly less expensive" (col. 8, line 40-42) and "Data that is stored in low access cylinders" (col. 32, line 10-15)) whereby the controller allocates hierarchically inferior storage for temporary storage unexpected mission-critical storage (i.e., "when data is collected and written to a cylinder separate from the normal de staging cylinder, that data is read-only or low access relative to the rest of the data in the logical cylinder ... to the hierarchical algorithm since they differentiate data into low access and regular access logical cylinders"" (col. 31, line 40-47) …

> ...
> But even if the Belsan comes shorting stating the single cabinet, it would still have been obvious to enclose all these driver or storage in a single enclosure not only to protect it from contamination but to make it portable.

Final Office Action, pp. 3-4. (Emphasis removed from original). Similar arguments were made with respect to independent claims 10, 18, 24, and 25. The Appellants respectfully traverse this rejection.

Anticipation under 35 U.S.C. § 102 can be found only if a single reference shows exactly what is claimed. *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 227 U.S.P.Q. 773 (Fed. Cir. 1985). For a prior art reference to anticipate under 35 U.S.C. § 102, every element of the claimed invention must be identically shown in a single reference. *In re Bond*, 910 F.2d 831,15 U.S.P.Q.2d 1566 (Fed. Cir. 1990). To maintain a proper rejection under 35 U.S.C. § 102, a single reference must teach each and every limitation of the rejected claim. *Atlas Powder v. E.I. duPont de Nemours & Co.*, 750 F.2d 1569, 224 U.S.P.Q. 409 (Fed. Cir. 1984). The prior art reference also must show the *identical* invention *"in as complete* detail *as contained in the ... claim"* to support a *prima facie* case of anticipation. *Richardson* v. *Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 U.S.P.Q. 2d 1913,1920 (Fed. Cir. 1989) (emphasis added). Accordingly, Applicants need only point to a single element not found in the cited reference to demonstrate that the cited reference fails to anticipate the claimed subject matter.

Additionally, the burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (B.P.A.I. 1979). To *establish prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka, 180 U.S.P.Q.* 580 (C.C.P.A. 1974). Although a showing of obviousness under 35 U.S.C. § 103 does not require an express teaching, suggestion or motivation to combine prior art references, such a showing has been described by the Federal Circuit as providing a "helpful insight" into the obviousness inquiry. *KSR Int'l. Co. v. Teleflex, Inc.*, No. 04-1350, 550 U.S. 398, 82

U.S.P.Q.2d 1385 (2007). Moreover, obviousness cannot be established by a mere showing that each claimed element is present in the prior art. *Id.* The Examiner must cite a compelling reason why a person having ordinary skill in the art would combine known elements in order to support a proper rejection under 35 U.S.C. § 103. *Id.*

Further, if the Examiner relies on a theory of inherency, the extrinsic evidence must make clear that the missing descriptive matter is *necessarily* present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. *In re Robertson,* 169 F.3d 743, 49 U.S.P.Q.2d 1949 (Fed. Cir. 1999). The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient. *Id.* In relying upon the theory of inherency, the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic *necessarily* flows from the teachings of the applied prior art. *Ex parte Levy,* 17 U.S.P.Q.2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original). The Examiner, in presenting the inherency argument, bears the evidentiary burden and must adequately satisfy this burden. *See id.*

Independent claims 1, 10, 18, 24, and 25 are not anticipated by or obvious over Belsan.

Independent claim 1 recites, *inter alia*, "a plurality of storage devices contained within the cabinet of at least three different and distinct *controller-to-storage device bus interface technology types*," and "a controller contained within the cabinet and coupled to the storage device plurality that executes hierarchical storage management and selectively controls usage of storage according to *the different and distinct controller-to-storage device bus interface technology type*." (Emphasis added). As disclosed in the specification, and as would be clearly understood by one of ordinary skill in the art, a controller-to-storage device bus interface technology type is a type of bus used to interface a controller to a storage device, such as Small Computer Systems Interface (SCSI), Fibre Channel (FC), and Serial AT-Attached (SATA). *See* Specification, para. [0027] (noting that the disk adapters can support either SCSI or Fibre Channel Arbitrated Loop (FC-AL) disk interfaces); *see also*, *id.*, para. [0038] (noting that an "embodiment

includes relatively higher performance Small Computer Systems Interface (SCSI) and/or Fibre Channel (FC) disks supplying storage for a first level of hierarchical storage 506 and relatively lower performance Serial AT-attached (SATA) disks supplying storage for a second level of hierarchical storage 506.").

By contrast, Belsan discloses a data processor connected to a file system that appears to use a single controller-to-storage device bus interface technology type. *See* Belsan, col. 4, ll. 15-33. The "data processor" disclosed by Belsan is described in terms suggesting that it is at least similar to a personal computer. *See id.*, col. 4, ll. 18-23 (stating that the data processor includes "an operating system 4 as well as a plurality of user programs 3"); *see also*, Fig. 1. The data processor is connected to a file system that consists of a plurality of data storage devices. *See id.*, col. 4, ll. 18-33; Fig. 1. Rather than using "three different and distinct controller-to-storage device bus interface technology types," as generally recited in the present claims, Belsan discloses storage units that appear to contain a single controller-to-storage device bus interface technology type. *See* Belsan, col. 4, ll. 18-22 (stating that "[t]he file server system 1 is connected to at least one data processor 2 by *a data channel 8* which functions to exchange data and control information between the data processor 2 and the file server system 1.") (emphasis added); *see also* Fig. 1. Moreover, Belsan makes no reference to different controller-to-storage technologies.

Apparently in relation to this claim element, the Examiner asserts that "*[t]he data storage and management capability can include changing the format of the data stored to accommodate* ***various combinations of heterogeneous data processors***" (col. 2, line 18-22)." Final Office Action, p. 3. (Emphasis in original.) However, nothing in this assertion, or in the corresponding text cited from Belsan, teaches, discloses, or even appears to be relevant to a controller-to-storage device bus interface technology type. Further, the Examiner apparently ignores the claim element, "three different and *distinct controller-to-storage device bus interface technology types*," asserting "*that* ***three different*** *are 'cache', 'disk drive array' and 'magnetic tape cartridge.'*" *Id.* (Emphasis in

original.) The Applicants respectfully note that all of the units described by the Examiner are devices and *none* of these devices are controller-to-storage unit bus interface types such as Small Computer Systems Interface (SCSI), Fibre Channel (FC), and Serial AT-Attached (SATA). For at least this reason, Belsan cannot anticipate this element in claim 1 or the similar elements in claims 10, 18, 24, and 25.

In response to this argument, the Examiner asserts that Belsan discloses three kinds of storage devices such as Cache, disk drive arrays, and magnetic tape. Final Office Action, pp. 11-12. The Examiner further asserts that data storage and management includes changing the format of data stored to accommodate various combinations of heterogeneous processors. *Id.* The Examiner appears to be asserting that use of different device bus interface technology is inherently disclosed based on the use of different the different storage types disclosed in Belsan.

However, the use of different device bus interface technology does not necessary flow from the disclosure of Belsan. Indeed, the only device bus interface technology type referred to in Belsan is the IBM OEMI specification. Further, the use of different storage device types does not require the use of different controller-to-storage device bus interface technology types. This fact is supported by Belsan, which states that the "[t]ape drive control unit interface 208 ... functions like a host channel interface so that the tape drive control unit 10 believes that data channel 20 is a normal IBM OEMI type channel." Belsan, col. 14, ll. 59-64. Furthermore, Belsan also states that "[a] plurality of bus input receivers 1603 and bus output drivers 1602 and tag receivers 1604 and drivers 1605 ... conform to the requirements set in the IBM OEMI specification so that normal IBM channels can be used to connect data storage subsystem 100 with a conventional tape drive control unit 10." *Id.* at col. 15, ll. 7-15. Additionally, Belsan does not disclose that changing the format of stored data to accommodate different processors is related in any way to the use of different device bus interface technologies. In fact, the use of various device bus interface technologies accommodates the use of different *storage device types*, not different processor types as disclosed in Belsan. Thus, the use of different device bus

interface technology does not necessary flow from the disclosure of Belsan. *See In re Robertson,* 49 U.S.P.Q.2d at 1950-51.

Further, Belsan does not disclose "a controller contained within the cabinet and coupled to the storage device plurality that executes hierarchical storage management and selectively controls usage of storage according to the different and distinct controller-to-storage device bus interface technology type," as recited in claim 1. Indeed, Belsan gives no indication that the controller disclosed is even capable of accessing multiple types of controller-to-storage bus interface technologies. *See* Belsan, col. 2, l. 46-col. 3, l. 25. For at least this additional reason, Belsan cannot anticipate claim 1 or claims 10, 18, 24, and 25.

Thus, with respect to the combined rejection under 35 U.S.C. §§ 102/103, the Applicants respectfully assert that nothing in Belsan, or in the Examiner's statements, indicates that these claim elements are necessarily present or obvious in light of the teachings of Belsan. More specifically, nothing in Belsan shows, indicates, or even implies the use of "three different and distinct controller-to-storage device bus interface technology types," or a controller capable of accessing storage devices using three different and distinct types of bus interfaces. Thus, the Applicants assert that one of ordinary skill in the art would not recognize these elements as inherent to Belsan. For at least these reasons, Belsan neither anticipates claims 1, 10, 18, 24, and 25 nor make them obvious.

Finally, the Examiner admits that Belsan "comes shorting [sic] stating the single cabinet," but alleges that "it would still have been obvious to enclose all these driver or storage in a single enclosure not only to protect it from contamination but to make it portable." Final Office Action, p. 4. However, nothing in Belsan shows, indicates, or even implies that a single cabinet may be used to contain multiple storage units using different controller-to-storage device bus interface technology types. Neither of the reasons provided by the Examiner can be found in Belsan, nor does either reason provide

an explanation of how the teaching of a single cabinet is obvious over Belsan. Specifically, if each separate storage device used in Belsan were kept in its own, original cabinet, the units would be both protected from contamination and, in fact, more portable than if all three devices were placed in a single cabinet. Thus, claims 1, 10, 18, 24, and 25 are allowable over Belsan for at least this additional reason.

For at least the reasons discussed above, Belsan does not anticipate or render obvious independent claims 1, 10, 18, 24 and 25, or their respective dependent claims 2-9, 11-17, and 19-23. Accordingly, the Appellants respectfully request that the Board reverse the rejection under 35 U.S.C. § 102(b)/103(a).

B. Ground of Rejection No. 2

The Appellants respectfully urge the Board to review and reverse the Examiner's second ground of rejection in which the Examiner rejected 5-9, 14-17, and 23 under 35 U.S.C. § 103(a) as being unpatentable over Belsan in view of Lee. Claims 5-9, 14-17, and 23 ultimately depend from independent claims 1, 10, and 18, respectively. As discussed above, Belsan fails to disclose all of the elements of independent claims 1, 10, and 18. Accordingly, claims 5-9, 14-17, and 23 are allowable over Belsan for at least the same reasons as discussed with respect to the first ground of rejection.

Further, Lee does not remedy the deficiencies of Belsan, either alone or in any hypothetical combination. Instead, Lee is directed to implementing a RAID 5 storage system using a log-structured approach. *See* Lee, col. 7, ll. 20-32. Lee does not disclose the use of "three different and distinct controller-to-storage device bus interface technology types," or a controller capable of accessing storage devices using three distinct types of bus interfaces, nor does the Examiner allege that it does. Instead, the Examiner merely cites Lee for teaching small computer Systems Interface (SCSI) and/or Fiber Channel (FC) storage. *See* Final Office Action, pp. 8-9.

For at least the reasons discussed above, the cited references, whether alone or in any hypothetical combination, fail to disclose all of the elements recited in independent claims 1, 10, and 18. Accordingly, these claims are allowable over Belsan and Lee. For at least the same reasons, their respective dependent claims 5-9, 14-17, and 23 are allowable over the cited references. Accordingly, the Appellants respectfully request that the Board reverse the rejection of claims 5-9, 14-17, and 23 under 35 U.S.C. § 103(a).

C. Ground of Rejection No. 3

The Appellants respectfully urge the Board to review and reverse the Examiner's third ground of rejection in which the Examiner rejected claim 22 under 35 U.S.C. § 103(a) as being unpatentable over Belsan in view of Hauck. Claim 22 ultimately depends from claim 18 and, therefore, is allowable over Belsan for at least the reasons discussed with respect to the first ground of rejection.

Further, Hauck does not remedy the deficiencies of Belsan, either alone or in any hypothetical combination. Instead, Hauck is directed to implementing a data storage system for maintaining cache coherency in a storage system. *See* Hauck, para. [0002]. Hauck does not disclose the use of "three different and distinct controller-to-storage device bus interface technology types," or a controller capable of accessing storage devices using three distinct types of bus interfaces, nor does the Examiner allege that it does. Instead, the Examiner merely cites Hauck for teaching a cache mirror connection between the at least two controller units. *See* Final Office Action, pp. 10-11.

For at least the reasons discussed above, the cited references, whether alone or in any hypothetical combination, fail to disclose all of the elements recited in independent claim 18. Accordingly, these claims are allowable over Belsan and Hauck. In addition, dependent claim 22 is allowable over the cited references for at least the same reasons. Accordingly, the Appellants respectfully request that the Board reverse the rejection of claim 22 under 35 U.S.C. § 103(a).

D. Request for Reversal of the Rejections

In view of the reasons set forth above, the Appellants respectfully request the Board to reverse the rejections of claims 1-4, 10-13, 18-21, 24, and 25 under 35 U.S.C. §§ 102(b) and 103(a). Further, the Appellants respectfully request the Board to reverse the rejections of claims 5-9, 14-17, and 23 under 35 U.S.C. § 103(a). Additionally, the Appellants respectfully request the Board to reverse the rejections of claim 22 U.S.C. § 103(a).

Conclusion

The Appellants respectfully submit that all pending claims are in condition for allowance. However, if the Examiner or Board wishes to resolve any other issues by way of a telephone conference, the Examiner or Board is kindly invited to contact the undersigned attorney at the telephone number indicated below.

Respectfully submitted,

Date: February 9, 2010

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8. **APPENDIX OF CLAIMS ON APPEAL**

Listing of Claims:

1. A storage system comprising:

a storage array comprising:

a cabinet;

a plurality of storage devices contained within the cabinet of at least three different and distinct controller-to-storage device bus interface technology types including volatile solid-state and nonvolatile disk types in a single array and having a respective class hierarchy; and

a controller contained within the cabinet and coupled to the storage device plurality that executes hierarchical storage management and selectively controls usage of storage according to the different and distinct controller-to-storage device bus interface technology type whereby the controller allocates hierarchically inferior storage for temporary storage, unexpected mission-critical storage, and hierarchical storage management (HSM)-type low usage data storage.

2. The storage device according to Claim 1 wherein:

the storage array contains an hierarchy of storage devices connected by at least three different and distinct controller-to-storage device bus interface technology types that have a respective performance hierarchy.

3. The storage device according to Claim 1 further comprising:

the storage array contains an hierarchy of storage devices connected by at least three different and distinct controller-to-storage device bus interface technology types that have a respective economic or cost hierarchy.

4. The storage device according to Claim 1 further comprising:

a solid state cache and shared memory coupled interior to the controller and supplying storage as a distinct controller-to-storage device bus interface technology type for a level of hierarchical storage.

5. The storage device according to Claim 1 further comprising:

Small Computer Systems Interface (SCSI) and/or Fibre Channel (FC) storage devices coupled to the controller by SCSI and/or FC buses and supplying storage as a distinct controller-to-storage device bus interface technology type for a level of hierarchical storage.

6. The storage device according to Claim 1 further comprising:

Serial AT-attached (SATA) storage devices coupled to the controller by a SATA bus and supplying storage as a distinct controller-to-storage device bus interface technology type for a level of hierarchical storage.

7. The storage device according to Claim 1 further comprising:

a solid state cache and shared memory coupled interior to the controller and supplying storage as a distinct controller-to-storage device bus interface technology type for a first level of hierarchical storage;

relatively higher performance Small Computer Systems Interface (SCSI) and/or Fibre Channel (FC) storage devices coupled to the controller by SCSI and/or FC buses and supplying storage as a distinct controller-to-storage device bus interface technology type for a second level of hierarchical storage;

relatively lower performance Serial AT-attached (SATA) storage devices coupled to the controller by a SATA bus and supplying storage as a distinct controller-to-storage device bus interface technology type for a third level of hierarchical storage; and

a process executable in the controller allocates storage capacity of the SATA storage devices to low access customer data and to short-term and unpredictable storage usage.

8. The storage device according to Claim 7 further comprising:
an hierarchical storage management controller for usage within a disk array utilizing Fibre Channel (FC) and SATA disk drives and that allocates SATA storage as uncommitted and unstructured storage.

9. The storage device according to Claim 7 further comprising:
an hierarchical storage management controller for usage within a disk array utilizing Fibre Channel (FC) and SATA disk drives and that allocates SATA storage for intra-array and/or inter-array data transfers including logical unit (LUN) copies and snapshots.

10. A method of managing information storage in a storage system comprising:
enclosing an hierarchy of storage devices of at least three different and distinct controller-to-storage device bus interface technology types including volatile solid-state and non-volatile disk types in a cabinet forming a single array and having a respective class hierarchy within a storage array;
selectively controlling information usage of storage according to the different and distinct controller-to-storage device bus interface technology type; and
using hierarchically inferior storage for temporary storage, unexpected mission critical storage, and hierarchical storage management (HSM)-type low usage data storage.

11. The method according to Claim 10 further comprising:
coupling an hierarchy of storage devices into the storage array including at least three different and distinct controller-to-storage device bus interface technology types that have a respective performance hierarchy.

12. The method according to Claim 10 further comprising:

coupling an hierarchy of storage devices into the storage array including at least three different and distinct controller-to-storage device bus interface technology types that have a respective economic or cost hierarchy.

13. The method according to Claim 10 further comprising:

combining an hierarchy of storage devices into the storage array including at least a volatile shared memory, a relatively higher performance nonvolatile storage, and a relatively lower performance non-volatile storage.

14. The method according to Claim 10 further comprising:

combining an hierarchy of storage devices into the storage array including at least a solid state cache and shared memory supplying storage for a first level of hierarchical storage, relatively higher performance Small Computer Systems Interface (SCSI) and/or Fibre Channel (FC) storage devices supplying storage for a second level of hierarchical storage, and relatively lower performance Serial AT-attached (SATA) storage devices supplying storage for a level of hierarchical storage.

15. The method according to Claim 14 further comprising:

allocating storage capacity of the SATA storage devices to low access customer data and to short-term and unpredictable storage usage.

16. The method according to Claim 14 further comprising:

allocating SATA storage as uncommitted and unstructured storage.

17. The method according to Claim 14 further comprising:

allocating SATA storage for intra-array and/or inter-array data transfers including logical unit (LUN) copies and snapshots.

18. A storage system comprising:
a disk array comprising:
a cabinet;
an hierarchy of disk adapters and coupled storage disks contained within the cabinet, the hierarchy of disk adapters and storage disks of at least two different and distinct controller-to-storage device bus interface technology types and having a respective class hierarchy; and
a controller coupled to the disk array and contained within the cabinet that executes an hierarchical storage management functionality that selectively controls access to the hierarchy of disk adapters and coupled storage disks whereby the controller allocates hierarchically inferior storage for temporary storage, unexpected mission-critical storage, and hierarchical storage management (HSM)-type low usage data storage.

19. The storage system according to Claim 18 further comprising:
a cache memory coupled interior to the controller and operable as an additional storage in the class hierarchy.

20. The storage system according to Claim 18 further comprising:
an hierarchy of storage devices having a respective performance hierarchy.

21. The storage system according to Claim 18 further comprising:
an hierarchy of storage devices having a respective economic or cost hierarchy.

22. The storage system according to Claim 18 further comprising:
the controller comprising at least two controller units; and
a mirror connection between the at least two controller units.

23. The storage system according to Claim 18 further comprising:

relatively higher performance Small Computer Systems Interface (SCSI) and/or Fibre Channel (FC) disks coupled to the controller by SCSI and/or FC buses and supplying storage for a first level of hierarchical storage;

relatively lower performance Serial AT-attached (SATA) disks coupled to the controller by a SATA bus and supplying storage for a second level of hierarchical storage; and

a process executable in the controller allocates storage capacity of the SATA disks to low access customer data and to short-term and unpredictable storage usage.

24. An article of manufacture comprising:

a tangible computer-readable medium having a program code for execution on a controller embodied therein for managing a storage system, the program code further comprising:

a code that causes the controller to intercommunicate among an hierarchy of storage devices of at least three different and distinct controller-to-storage device bus interface technology types including volatile solid-state and non-volatile disk types in a cabinet forming a single array and having a respective class hierarchy within a storage array;

a code that causes the controller to selectively control information access to the hierarchy of storage devices within the storage array; and

a code that causes the controller to use hierarchically inferior storage for temporary storage, unexpected mission-critical storage, and hierarchical storage management (HSM)-type low usage data storage.

25. A storage system comprising:

means for coupling an hierarchy of storage devices of at least three different and distinct controller-to-storage device bus interface technology types including volatile solid-state and non-volatile disk types in a cabinet

forming a single array and having a respective class hierarchy within a storage array;

means for selectively controlling information access to the hierarchy of storage devices within the storage array; and

means for using hierarchically inferior storage for temporary storage, unexpected mission-critical storage, and hierarchical storage management (HSM)-type low usage data storage.

9. **EVIDENCE APPENDIX**

None.

10. **RELATED PROCEEDINGS APPENDIX**

None.